

DESCRIPTION FOR THE GENERAL PUBLIC

Caffeine intake via coffee drinking leads in humans to the increase of blood pressure, but such an increase can also occur after drinking decaffeinated beverage which smells like coffee. Rats, on the other hand, experience difficulties in learning a path after scopolamine intake, but they can show path learning deficits even after drinking sweetened milk, if scopolamine was delivered to them earlier as a sweetened milk solution. Both these examples describe typical placebo effects. One can try to define this effect as an impact of a factor (characteristic smell, sweet taste) that has no potential for making such impact (coffee smell alone does not affect circulatory system, just as sweetened milk does not cause learning deficits). There is an outgoing scientific debate over the mechanism of placebo effect. Most broadly accepted opinion is that conscious expectancies about results of stimuli are of key importance for the occurrence of placebo effects. As such, decaffeinated beverage and sweetened milk affect humans and rats, because they expect these factors to work. Expectancies are, of course, nothing more than cognitive theoretical constructs, but nevertheless their occurrence is postulated in all organisms displaying placebo effects. Another opinion states, however, that placebo effects are specific instances of the conditioned reactions created in the classical conditioning process. This process works in humans, but probably also in all organisms capable of associating two events. Classical conditioning was first described by Ivan Pavlov, and involves co-occurrence of the unconditioned stimulus, which results in the unconditioned reaction, with the conditioned stimulus, which in turn triggers the conditioned reaction. Typical research in regard to conditioning involves behaviour reinforcement, i.e. instrumental conditioning. For instance, pigeons can be learned to turn twice around their axis at the specific sound, because then they will receive a snack. Similarly, bees can be learned to extend their proboscis at the smell of lemon in return for sugar solution. Placebo research, however, involves conditioned reactions elicited by antecedent stimuli, like in the case of classical conditioning, and with pronounced physiological consequences. For instance, as shown by Pavlov himself, dogs treated with morphine react unconditionally with hyperthermia (increase in body temperature), and morphine treatment with co-occurring conditioned stimulus (coloured light) results in conditioned hyperthermic reaction at the sight of coloured light alone. This provides clear evidence of conditioned placebo effect in dogs.

Here, we attempt for the first time to show the placebo effect in an invertebrate. To achieve that, we will use conditioning procedure on the workers of the honeybee in two separate experiments. We will use visual (colour) or chemical (odour) conditioned stimuli, paired with ethanol vapour (unconditioned stimulus). Exposing bees to ethanol vapour leads to easily observable behavioural effects (unconditioned reactions), such as proboscis extension, frequent self-grooming, and walking activity disorders (lying on the side or back). Our aim in these experiments will be to show whether it is possible to cause the display of similar, conditioned reactions, after exposing bees to water instead of ethanol, but still under the influence of conditioned stimuli (visual or chemical). In other words, we will check whether bees act as if they were exposed to ethanol, when they were in fact exposed to water in conditions similar to these accompanying ethanol exposure. Such situation would be similar to being drunk after drinking water from bottle with beer etiquette that caused drunkenness in the past. Pilot experiment indicates that such effect in the honeybee does occur. Showing it in an invertebrate with a simple nervous system will raise important questions about expectancies-based placebo effect mechanism.

Publishing the results of our experiments will enable adding important conclusions to the discussion on placebo effect mechanism. Interdisciplinarity of this project, on the other hand, will raise interest not only from psychologists, anthropologists, and medical professionals, which conduct placebo research most frequently, but also from behavioural ecologists and entomologists. Therefore, we expect to have a great chance of publishing in journals with high impact factor and broad readership, but also to popularize our conclusions broadly for public opinion.